

**DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
ROAD DEVELOPMENT AUTHORITY (RDA)**

**THE PROJECT FOR CAPACITY
DEVELOPMENT ON BRIDGE
MANAGEMENT
IN SRI LANKA**

PROJECT COMPLETION REPORT

JANUARY 2018

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**


**JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.,
CENTRAL NIPPON EXPRESSWAY COMPANY LIMITED.
DAINICHI CONSULTANT INC.**

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PROJECT COMPLETION REPORT

The Project for Capacity Development on Bridge Management
in the Democratic Socialist Republic of Sri Lanka

Date of Submission: November 13, 2017

 18.12.2017

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ABBREVIATIONS

Organizations	
GOSL	Government of Sri Lanka
JICA	Japan International Cooperation Agency
RDA	Road Development Authority
Divisions in RDA	
BAU	Bridge Assessment Unit (1990s)
BM&AU	Bridge Management and Assessment Unit
EOM&M	Expressway Operation, Maintenance and Management
ES	Engineering Services
M&M	Maintenance and Management
PMU	Project Management Unit
RBCU	Rural Bridges Construction Unit
R&D	Research and Development
Positions in RDA	
ADG	Additional Director General
CE	Chief Engineer
C/P	Counterpart
DG	Director General
EE	Executive Engineer
PD	Provincial Director
TO	Technical Officer
Manuals	
BMM1997	Bridge Maintenance Manual /1997 RDA
RMM1989	Road Maintenance Manual /1989.2 RDA
VRCSG	Visual Road Condition Surveys Guidelines / 2012.6 RDA Planning Division
Others	
BMS	Bridge Management System
DAC	Development Assistance Committee
JCC	Joint Coordinating Committee
JICA PT	JICA Project Team
ODA	Official Development Assistance
OJT	On-the-Job Training
PDM	Project Design Matrix
PC	Planning Committee
PO	Plan of Operation
PM	Project Monitoring
WG	Working Group
WS	Work Shop

MAP of the Sample Provinces



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PHOTOS



2015/2/25 Kick-off meeting



2015/3/10 Meeting with BM&AU member



2015/3/18 Meeting at Training division



2015/3/30 Site investigation (Galle)



2015/4/8 Workshop for bridge inspection



2015/6/22 Meeting at southern highway office



2015/6/26 Meeting at RDA head office
(WB-HIMS/JICA-BMS)



2015/7/6 Meeting with BM&AU member
for bridge inventory

S J



2015/7/8-10 Site investigation
(Central Province)



2015/7/21-24 Site investigation
(Northern Province)



2015/8/7 The First JCC meeting



2015/8/20 Theoretical seminar



2015/8/24 Site seminar for TO



2015/9/15 OJT for bridge inspection to BM&AU



2015/9/22 OJT for using pole camera



2015/10/13 Site investigation of repair work
(Jaffna)

5-7



2015/10/13 Baseline survey (Akkaraipattu)



2015/10/25-11/12 The First training in Japan



2015/10/25-11/12 The First training in Japan



2015/11/5 Baseline survey (Nuwara Eliya)



2015/11/30 OJT for bridge inspection



2015/12/18 The Second JCC meeting



2015/12/18 The Second JCC meeting



2015/12/9 OJT for bridge inspection





2016/1/15 Seminar for bridge repair



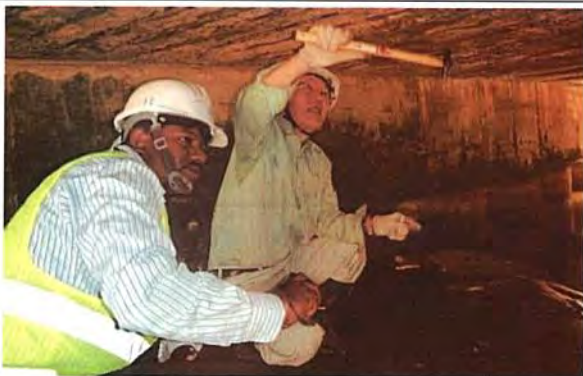
2016/2/19 Meeting for Bridge inspection and diagnosis manual with BM&AU Members



2016/2/20-27 Invitation program



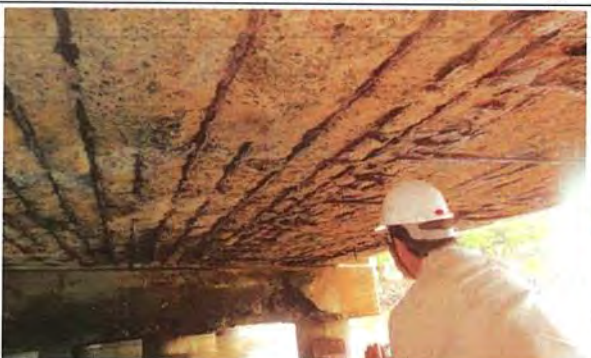
2016/2/20-27 Invitation program



2016/3/21 Site investigation for damaged bridge



2016/4/27 Seminar for bridge repair method



2016/5/29 Site investigation for damaged bridge



2016/6/28 The First PC meeting



2016/6/30 The Third JCC meeting



2016/6/30 Awareness survey for BMS



2016/7/26 Awareness survey for BMS



2016/7/27 Bridge inspection (Western Province)



2016/8/5 Bridge inspection (Southern Province)



2016/8/10 Bridge inspection (Central Province)



2016/8/24 The First Workshop

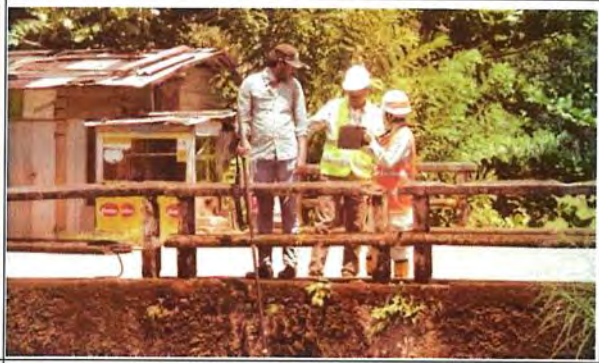


2016/9/6 Additional Workshop

5-7



2016/10/7 Bridge inspection (Western Province)



2016/10/11 Bridge inspection (Southern Province)



2016/10/20 The Second Workshop



2016/10/21 Bridge inspection (Central Province)



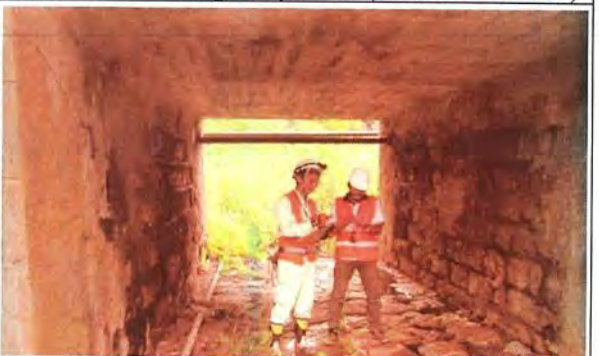
2016/11/25 The Third Workshop



2016/11/23 Bridge inspection (Western Province)



2016/11/30 Bridge inspection (Southern Province)



2016/12/6 Bridge inspection (Central Province)



2016/12/20 The Fourth JCC meeting



2017/1/10-20 The Second training in Japan



2017/1/10-20 The Second training in Japan



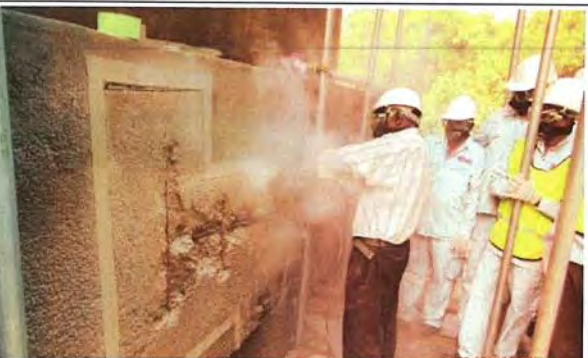
2017/1/17 Demonstration for plastering method



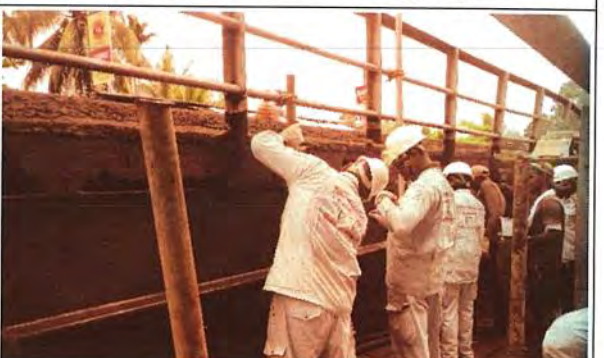
2017/1/20 Demonstration for zone painting



2017/2/20 Seminar for bridge repair



2017/2/21 Demonstration for plastering method



2017/2/28 Demonstration for zone painting

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2017/3/4 Site investigation (Northern province)



2017/4/5 OJT for operation of BIV



2017/4/7 Handing over ceremony of BIV



2017/5/16 The Fifth Workshop



2017/5/29 OJT for using BIV



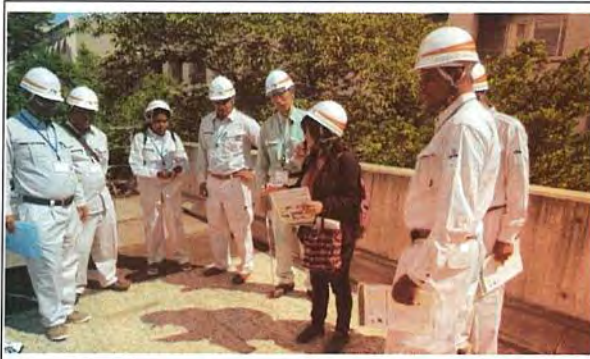
2017/5/30 OJT of traffic control for using BIV



2017/6/13 Bridge inspection using BIV



2017/6/1 The Third PC meeting



2017/6/11-24 The Third Training in Japan



2017/6/11-24 The Third Training in Japan



2017/7/25 Seminar in Central Province



2017/7/26 Seminar in Western Province



2017/7/27 Seminar in Southern Province



2017/8/19 Volunteer cleaning activity



2017/9/29 Prize Giving Ceremony (PR Activity)



2017/10/17 4th PC Meeting

I. Basic Information of the Project

1. Country

Democratic Socialist Republic of Sri Lanka

2. Title of the Project

The Project for Capacity Development on Bridge Management in the Democratic Socialist Republic of Sri Lanka

3. Duration of the Project (Planned and Actual)

Feb. 06th 2015 – Feb. 23rd 2018 (3 years) (Planned and Actual)

4. Background (from the Record of Discussions (R/D))

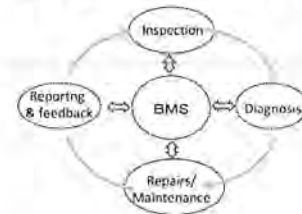
There are 4,800 bridges in A and B Class roads, which are not covered under a comprehensive maintenance strategy due to non-availability of a database that consists of life-span, durability and maintenance plan. Although RDA has road maintenance system, currently, it does not have any institutional and technical mechanism for bridge maintenance. Establishment of a bridge maintenance system and a Bridge Assessment Unit in RDA is an essential requirement to maintain bridges effectively to ensure safety of road users and smooth flow of traffic.

5. Overall Goal and Project Purpose (PDM Version 4)

• Overall Goal:

RDA conducts bridge management in a systematic manner throughout the country in accordance to the Bridge Management Cycle.*

*Note: The Following figure shows the concept of the Bridge Management Cycle:



• Project Purpose

Institutional capacity of RDA on bridge management is improved.

6. Implementing Agency

Ministry of Higher Education and Highways and Road Development Authority

II. Results of the Project

I. Results of the Project

1-1. Input by the Japanese side (Planned and Actual)

Table 1 Input – Japanese Side

Inputs	Plan (PDM ver. 0)	Actual (as of Oct. 31 st , 2017)
(1) Experts	<p>Long-term: 1 person (24.00 man-months)</p> <ul style="list-style-type: none"> ● Bridge Management Policy <p>Short-term: (90.00 man-months)</p> <ul style="list-style-type: none"> ● Bridge Management Plan ● Bridge Inspection ● Bridge Diagnosis ● Bridge Remediation ● Asset Management ● System / Database 	<p>Long-term:</p> <ul style="list-style-type: none"> ● Not dispatched <p>Short-term: (122.12 man-months in total (man-months were increased from 90.00 to 122.65 man-months))</p> <ul style="list-style-type: none"> ● Bridge Management Plan (Policy) ● Bridge Inspection ● Bridge Diagnosis ● Bridge Repair (Additional assignment sept.2016) ● Asset Management ● System / Database
(2) Training in Japan / Third Countries	<p>Training in Japan: 3 times (once/ year)</p>	<p>Training in Japan:</p> <ul style="list-style-type: none"> ● The 1st training was conducted from Oct. 25th 2015 to Nov.12th 2015 on the theme of bridge maintenance and management, 'Training on Strategic Bridge Management in Japan'. No. of participants: 6 ● Invitation program was conducted with the attendance of Additional Secretary (Engineering) from the Ministry of Highways and 3 senior managers of RDA from Feb.20th to 27th 2016 under the theme of bridge management policy 'Practice of Bridge Maintenance in Japan'. ● The 2nd training was conducted from Jan 8th – 21st, 2017 on the theme of bridge maintenance and management, "Training on Strategic Bridge management in Japan". Number of participants: 10. ● The 3rd training was conducted from June 11th – 24th, 2017 on the theme of bridge maintenance and management, "Training on Strategic Bridge Management in Japan". Number of participants: 10.
(3) Equipment	<p>A bridge inspection vehicle</p>	<ul style="list-style-type: none"> ● 2 pole cameras and 7 pole cameras were handed over to the Project on July 01st, 2016 and November 21st, 2016 respectively. ● A bridge inspection vehicle was handed over to the Project on April 7th, 2017. ● Total amount of the equipment provided by the Japanese side was 53,615,588 JPY ● Within 53,615,588 JPY, Bridge Inspection Vehicle 49,247,744 JPY

Project Completion Report:

The Project for Capacity Development on Bridge Management in the Democratic Socialist Republic of Sri Lanka

Inputs	Plan (PDM ver. 0)	Actual (as of Oct. 31 st , 2017)
(4) Project period	Feb. 6 th , 2015 – Feb. 23 rd , 2018 (3 years)	Feb. 6 th , 2015 – Feb. 23 rd , 2018 (3 years)
(5) Project Cost	494 million JPY	508 million JPY

1-2. Input by the Sri Lankan side (Planned and Actual)

Table 2 Input – Sri Lankan Side

Inputs	Plan (PDM Ver. 0)	Actual (as of Oct 31 st , 2017)												
Assignment of Counterpart Officers	Director General as a Project Director Director in Planning Division as a Project Manager BAU (15 engineers and staff)	Director General as a Project Director Director Engineering Services as a Project Manager BM&AU (Engineers and staff of 12 numbers in total were appointed) <u>Senior Engineer 1, System analyst 2 are still vacant at Oct 31st.</u>												
Project Office	The project office with necessary equipment is offered in RDA Head Office Building	An office space and necessary equipment were provided at Sethsiripaya Complex at Battaramulla.												
Facilities and Equipment	Procurement of inspection equipment Safety Equipment (Helmet, Safety Buckling Belt, Safety Shoes) Testing Hummer (1/2 pounds) Tape Measurc / Leveling Staff Binoculars Chalk Sticks / Blackboard Camera	All the equipment was provided.												
Project Cost	Local Cost Travelling cost Training/ seminar cost Other necessary costs	Local Cost Travelling cost Training/ seminar cost Other necessary costs GOSL budget for the Project Allocation (Unit: '000 Rs.) <table border="1"> <thead> <tr> <th>2015</th> <th>2016</th> <th>2017</th> </tr> </thead> <tbody> <tr> <td>24,200</td> <td>20,000</td> <td>27,500</td> </tr> </tbody> </table> Actual Expenditure (Unit: 'Rs.) <table border="1"> <thead> <tr> <th>2015</th> <th>2016</th> <th>2017</th> </tr> </thead> <tbody> <tr> <td>700</td> <td>6,000</td> <td>21,200</td> </tr> </tbody> </table>	2015	2016	2017	24,200	20,000	27,500	2015	2016	2017	700	6,000	21,200
2015	2016	2017												
24,200	20,000	27,500												
2015	2016	2017												
700	6,000	21,200												

1-3. Activities (Planned and Actual)

Table 3 Summary of Progress of Activities (As of Oct. 31st, 2017)

Activities	Completed	Will be completed by the end of the Project (by Jan 2018)	Will not be completed by the end of the Project (by Jan 2018)
1-1. Current status of bridge management is reviewed and analyzed.	✓		
1-2. Bridge management strategy is drafted.	✓		
1-3. Bridge management strategy is disseminated for RDA head office and regional offices.		✓	
1-4. Formulate a bridge management plan for the bridges in the sample provinces, which were inspected and diagnosed.	✓		
2-1. Roles and responsibilities of RDA head office and regional offices on bridge management is reviewed, discussed and drafted.	✓		
2-2. Work procedure of RDA head office and regional offices on bridge management is reviewed, discussed and drafted.	✓		
2-3. Prepare an organizational chart with roles, responsibilities and authorities, plans for staff allocation and other necessary resources and cost estimation for bridge management.	✓		
3-1. Existing bridge maintenance manuals are reviewed and issues identified are summarized.	✓		
3-2. Bridge inspection, diagnosis and repair manuals as well as bridge management guidelines are drafted.	✓		
3-3. Bridge inspection, diagnosis and repair manuals as well as bridge management guidelines (draft) are explained to RDA head office and regional offices by BM&AU to obtain their feedback.	✓		
3-4. Bridge inspection, diagnosis and repair manuals as well as bridge management guidelines are finalised and distributed to related divisions.		✓	
4-1. Existing database is reviewed and analyzed.	✓		
4-2. BMS is developed with discussion on specifications.	✓		
4-3. Necessary data for bridges in the sample provinces is entered into the BMS by BM&AU staff.	✓		

Activities	Completed	Will be completed by the end of the Project (by Jan 2018)	Will not be completed by the end of the Project (by Jan 2018)
5-1. Theoretical seminars are conducted for staff in RDA head office and regional offices in sample provinces.	✓		
5-2. Practical seminars are conducted for staff in RDA head office and regional officers in sample provinces.	✓		
5-3. On the Job Trainings on bridge inspection, diagnosis and repair are conducted in sample provinces.	✓		
5-4. Human resources development plan is prepared for the whole region of the country.		✓	

(1) Activities for Output 1

Activities of 1-2, 1-3 and 1-4 were delayed at the initial stage due to unavailability of a JICA long-term expert. RDA and JICA established a Planning Committee (PC), composed of RDA, JICA Head Office and JICA PT, for conducting discussions necessary to carry out these activities, in order to compensate the absence of a JICA long-term expert. The PC meetings were held as shown in Table 4.

Table 4-1 Record of the PC Meeting

	Date	Topics	Nos. of Participants
1	June 28 th 2016	<ul style="list-style-type: none"> • To establish Planning Committee (PC) • To bring up mutual understanding of issues on bridge management • To agree tentative schedule and themes for PC 	RDA: 5 JICA-PT: 4 JICA:2
2	June 01 st 2017	<ul style="list-style-type: none"> • Achievement 1 of Workshop and PC from 2016 to 2017 • Remaining Topics of Workshop and PC • Important Issues to be Finalised • Draft Budget Plan 	RDA: 7 JICA-PT: 3
3	Oct. 17 th 2017	<ul style="list-style-type: none"> • Bridge Management Strategy • Bridge Maintenance Plan • Institutional Framework for Bridge Management in RDA • Progress of Project Activities 	RDA: 5 JICA-PT: 3
4	Oct. 26 th 2017	<ul style="list-style-type: none"> • Bridge Management Strategy • Human Resources Development Plan 	RDA: 7 JICA-PT: 2

Table 4-2 Record of Workshops

	Date	Topics	Nos. of Participants
1	24/Aug/2016	<ul style="list-style-type: none"> Flow of Bridge Maintenance Work 	RDA: 6 JICA PT: 4
2	20/Oct/2016	<ul style="list-style-type: none"> Issues Extracted from Baseline Surveys Bridge Inspection and Evaluation System in Several Countries and Bridge Inspection System Provided to RDA, Sri Lanka Landing Points of PC Meeting / Program of Workshop and PC Meeting Bridge Management Indices and Target Bridge Management Levels in Japan Bridge Management Plans in Shizuoka Prefecture, Japan Report from RDA Working Group (WG) on September 13, 2016 Progress of Project Activities Issues on Institutional Framework for Bridge Management within RDA 	RDA: 6 JICA PT: 3
3	25/Nov/2016	<ul style="list-style-type: none"> Project Concept Based on Baseline Analysis Definition of Health Index (HI) & Its Usage Target Management Standards Evaluation of Conditions of Bridges Cost Estimate of Bridge Repairs in BMS Prioritization (Evaluation items , Weighting Factors) Report from WG held on Nov. 9, 2016 	RDA: 7 JICA PT: 2
4	08/Mar/2017	<ul style="list-style-type: none"> Revision of Bridge Inspection Manual Selection of Bridges for Reconstruction Standard Bridge Repair Method for Health Index (Unit Rates for Bridge Repair) 	RDA: 5 JICA PT: 2
5	25/Apr/2017	<ul style="list-style-type: none"> Schedule of WS and PC from April to June 2017 Definition of Health Index (HI) = 0 Definition of Important Index Institutional Framework of Bridge Maintenance 	RDA: 6 JICA PT: 3
6	16/May/2017	<ul style="list-style-type: none"> Calculation Result of BMS by Using Inspection Data from Sample Provinces / Bridge Maintenance Scenario Bridge Repair and Maintenance Plan Institutional Framework for Bridge Maintenance Work in RDA Next PC Meeting (Strategy and Institutional Framework) 	RDA: 6 JICA PT: 4
7	28/Sep/2017	<ul style="list-style-type: none"> Bridge Management Procedure Bridge Diagnosis and Emergency Action 	RDA: 5 JICA PT: 3
8	04/Oct/2017	<ul style="list-style-type: none"> Analysis of Bridge Inspection Results in 3 Sample Provinces RDA Action Plan for Bridge Management Amendment of Work Procedure JICA Recommendation of Human Resources Development Plan 	RDA: 7 JICA PT: 4

In the WS meetings, bridge management strategies, as well as bridge management plans, inspection and evaluation system and others of Japan and other countries were introduced; and a series of discussions about the concept and contents of the bridge management strategy in Sri Lanka were held. After explanation and discussion in workshop important issues were finalized in PC meeting.

The bridge management strategy was discussed at the PC meeting held on Oct. 17th and 26th, 2017, (Oct.17th 2017 discussion was not enough, Oct. 26th 2017 Additional PC was held) and its draft was presented by RDA at the JCC meeting held on October 31st, 2017. It is going to be finalized and approved at a Board Meeting of RDA in January 2018.

The bridge management plan was developed using the BMS as below.

- Bridge repair and maintenance plans with management level of 100, 75, 50 and 25 for only bridges in sample provinces;
- Bridge reconstruction plan for only bridges in sample provinces.

(2) Activities for Output 2 :

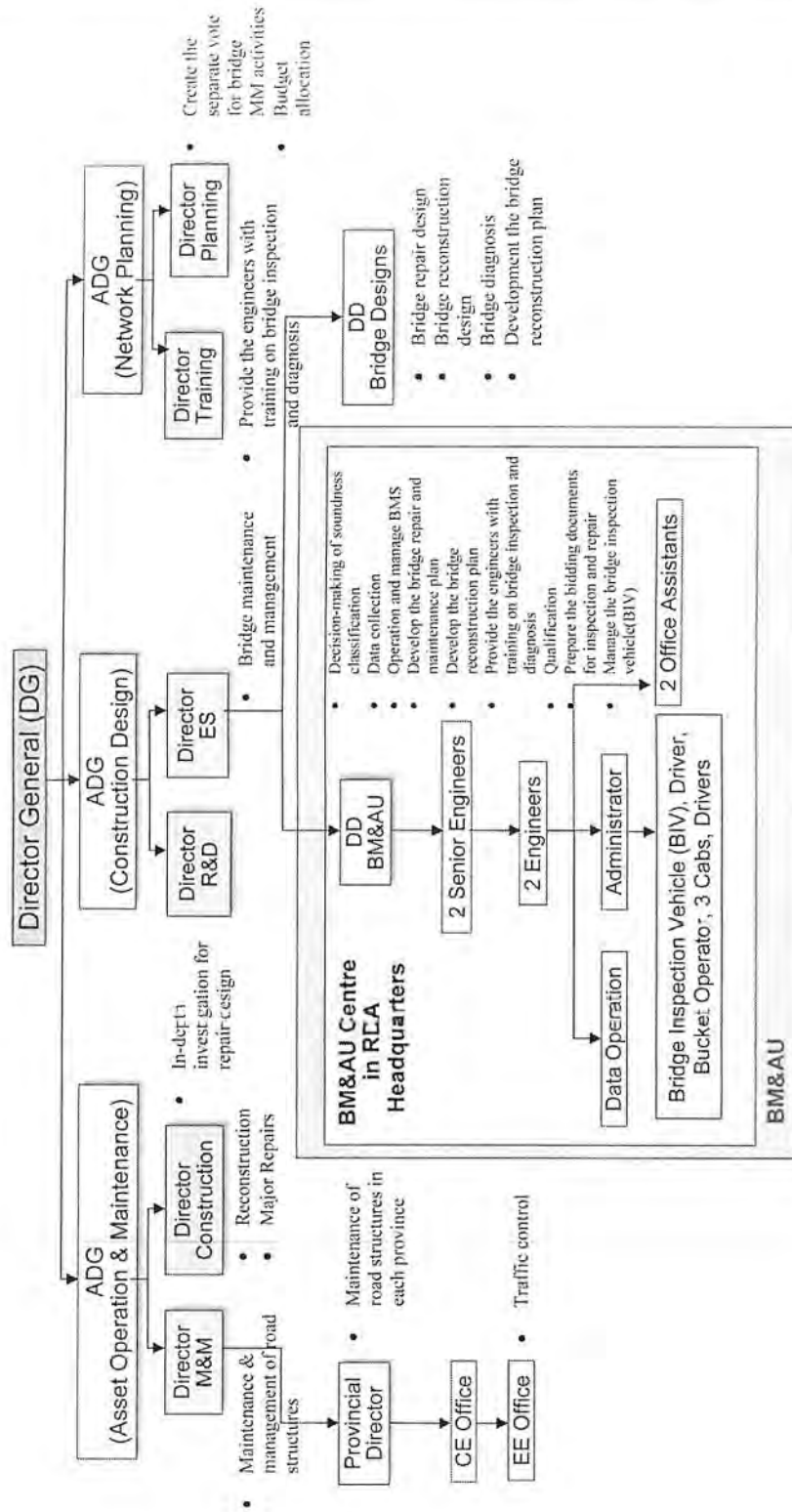
For re-establishing the institutional framework of RDA head office and regional offices on bridge management, a Working Group, consists of Additional Director General (Construction Design), Additional Director General (Projects), Director (Engineering Services), Director (Planning), Director (M&M), Deputy Director (BM&AU), Deputy Director (Bridge Designs), Engineer (Bridge Designs), Engineer (Planning Division) and Engineers (BM&AU) of RDA, was formed. Meetings of the Working Group were held 4 times, as shown in Table 5:

Table 5 Record of the Discussion held by the Working Group

No.	Held on:	Topics for discussion
1	Jun. 23th, 2016	· Organizational structure of BM&AU
2	Sep. 13th, 2016	· Responsibilities for routine maintenance and detail inspection
3	Dec. 14th, 2016	· Responsibility of minor and major repairs · The bridge inspection system in future. · Budget arrangement for BM&AU related activities · Plan for training on bridge maintenance · Responsible departments for the Bridge Inspection Vehicle
4	Oct. 4th, 2017	· Bridge Management Strategy · Role and Responsibility of maintenance work · Minor Repair (Steel and Concrete bridge) · Riverbed degradation problem

Finally, the institutional framework of RDA head office and regional offices on bridge management was decided as shown in Figure 1:

Figure 1 Organizational Setup of BM&AU



5/11

(3) Activities for Output 3

The development of inspection and diagnosis manuals had been conducted as scheduled. However, after careful review, it was found that the manuals need a fundamental revision due to the following reasons:

- The manuals were developed with a general assumption that all the damage found in the inspections are to be repaired without any financial constraints. Therefore, there were features in the forms in the manuals for recording the quantities of damage rather than for comparing the soundness among bridges or bridge members and prioritizing the bridges for repairs, strengthening and reconstructions.
- It was suggested by ADG (CD) that, in addition to the “area of damage (extent)”, “depth of damage (severity)” need to be inspected and recorded to judge degree of risks of bridges.

The JICA PT and RDA agreed that the bridge inspection and diagnosis manuals were revised to have the above-mentioned features and items.

Although the manuals were planned to be completed by Oct. 2016, it was delayed for around one year due to the need of the fundamental revisions. JICA PT has been working on setting up indexes (evaluation criteria and weighing factors) for soundness, importance of bridges and functional obsolescence of bridges, which are necessary for quantification of bridge conditions and prioritizations for taking measures to be incorporated in the bridge inspection and diagnosis manual. This work took more time than expected.

Due to the delay of bridge inspection and diagnosis manuals, a series of draft manuals related to bridge management system had been submitted to RDA in July 2017 for its comments and feedbacks.

Bridge repair manual was submitted to RDA in July 2017.

The final draft of manuals and one guideline were submitted to the Director, Engineering Services of RDA on Oct. 9th 2017 for his comments. They will be finalised by incorporating his comments, approved by a Board Meeting of RDA, printed and circulated to relevant offices in RDA as official documents:

- Bridge Management Guideline & Procedure Manual
- Inventory Development Manual
- Bridge Inspection & Diagnosis Manual
- Bridge Repair Manual
- Bridge Management System Manual

(4) Activities for Output 4

The JICA PT re-started the development of the BMS in May 2016 after an interruption for about a

year to dispatch of an expert in-charge of BMS. The BMS comprises three sub-systems, namely, Bridge Database System (BDS), Bridge Inspection Support System (BISS) and Bridge Repair and Maintenance System (BRMS).

It took more time than expected to complete the system development work mainly due to the following reasons:

- Completion of the bridge inspection, diagnosis and repair manuals, which are closely related to the systems, were delayed.
- There was a request from RDA to include a function in the BMS for prioritizing needs for reconstruction of bridges.

The BMS has been developed to certain extent and handed over in July 2017, along with the following sub-systems to the Director, Engineering Services in RDA. The Japanese Experts are fixing bugs found in the said systems as of Oct. 2017.

- Bridge Database System (BDS)
- Bridge Inspection Support System (BISS) and
- Bridge Repair and Maintenance System (BRMS).

A budget for maintenance and repair of bridges was produced by the BMS and was proposed as a part of the annual budget of RDA in 2018 (700 Million in total).

Staffs of BM&AU, including those working in the non-sample provinces, are accessing the BMS online through the BMS website. They are entering the data as soon as they return to the office from the inspection on the same day. Therefore, there is no time gap between the inspection and data entry. In this way, BMS will be expanded to entire country.

(5) Activities for Output 5

With regard to the activities 5-1 and 5-2, the theoretical and practical seminars were conducted as described in Table 6.

Table 6 Seminars Conducted

Subject	Period	Contents	No. of Participants	Understanding of the participants* (%)
Theoretical and Practical seminar	Aug. 08 th 2015 (Theoretical seminar)	1. Outline of the Project 2. Bridge maintenance work 3. Purpose of inspection 4. Explanation of bridge type 5. Inspection work 6. Diagnosis 7. BMS	35	78%

Subject	Period	Contents	No. of Participants	Understanding of the participants* (%)
		8. Repair work 9. Report from sample provinces		
	Aug. 21 st 2015 (Practical seminar at site)	Recognition of present condition of RDA Bridge. Explanation of site inspection	25	
	Aug. 24 th 2015 (Practical Seminar at site)	Recognition of present condition of RDA Bridge. Explanation of site inspection	18	
Bridge Repair Seminar	Jan 16 th -Jan 24 th 2017	1. General information of bridge repair method 2. Plastering method for concrete structure and zone painting for steel structure	20	n/a
	Feb. 20 th - 02 nd March 2017	3. Demonstration for plastering method for concrete structure and zone painting for steel structure 4. Generation of rust 5. Site visit – Inspection method	20	n/a
Bridge Maintenance Seminar	July 25 th 2017 (Central)	1. Functions required of bridges 2. Bridge management 3. Bridge inspection	24	97%
	July 26 th 2017 (Western)	4. Bridge diagnosis 5. Bridge repair	23	94%
	July 27 th 2017 (Southern)		21	94%
Bridge Inspection Seminar	Sept. 19 th 2017 (Western)	1. Outline of the Project 2. Bridge inspection 3. Bridge diagnosis & emergency action	16	n/a
	Sept. 22 nd 2017 (Southern)	4. Desk bridge inspection 5. On-site inspection/ inspection results review	27	97%
	Sept. 19 th 2017 (Central)	6. System data input	32	95%

Note: Results of the questionnaire conducted at the end of the seminar

The staff of BM&AU, as trainers, conducted a training course for the newly recruited engineers of RDA in Sept. 27, 2017, as a part of an induction training of RDA. It was decided that BM&AU will conduct training once every month so that all engineers of RDA would receive training on bridge management. For Activity 5-3, on-the-job training (OJT) had been conducted based on the previous inspection and diagnosis manuals; however, the OJT will need to be conducted once again if the manuals are revised. The OJT for bridge repairs based on the revised manual,

including trial bridge repair works, was conducted for four weeks (two weeks each for two groups) in January and Feb. 2017. There was an active participation of the staff of the target provinces in the OJT. 30 number of RDA staff participated in the OJT in total. Staff of BM&AU played an important role in the OJT by conducting demonstration and other activities.

Training in Japan was conducted 3 times as follows:

- The 1st training was conducted from Oct.25th 2015 to Nov.12th 2015 on the theme of bridge maintenance and management, "Training on Strategic Bridge Management in Japan". Number of participants was 6. There were many lectures and site visits such as Yokohama city, Nagoya University, some working sites in Nexco Central, etc. 2 weeks schedule was tight and some trainee looked little tired, interested in the topics and their understanding was good based on trainee's comment. Size and way of work of bridge maintenance organization of road administrators in Japan is different from RDA. Some trainees felt confused about the difference between them. The training was held in winter, protection from cold weather is important at site. Down jacket and others were provided to trainees.
- The 2nd training was conducted from Jan. 08th to 21st, 2017 on the theme of bridge maintenance and management, "Training on Strategic Bridge management in Japan" for the engineers of BM&AU and ADG (Planning) and Director (M&M). Number of participants was 10. They have visited inspection and repair sites, and participated in the lectures at MLIT, Nagasaki University and so on. It was a precious opportunity for the participants to learn practices on bridge maintenance and management in Japan and to witness various places related not only to the bridge engineering but also to working procedure of government office or local government offices in Japan. The JICA PT observed that some participants were active in learning by raising questions and taking notes during the visits and lectures.
- The 3rd training was conducted from June 11th to 24th, 2017 on the theme of bridge maintenance and management, "Training on Strategic Bridge management in Japan" for the engineers. Number of participants was 10. They have visited inspection and repair sites, and participated in the lectures at MLIT, Nagasaki University and so on. It was precious opportunities for the participants to learn practice on bridge maintenance and management in Japan and witness various places related bridge engineering. This time 2 Provincial Directors (PD) also attended the training. BM&AU Provincial offices are working under PD, PD's deep understanding for bridge maintenance work is important. 2 PD leaned many from this training and had chance to discuss bridge maintenance together with other trainees.

(6) Other activities (Activities for Public Relations)

The following public relation activities were conducted successfully:

- Work Uniform: Work uniform with the project symbol was made and wore by the PT for making the residents around the areas of activity aware of the Project. It also contributed to creating team spirit of the PT.
- Development and distribution of project leaflets: Two types of leaflets were developed, printed and distributed at the time of the volunteer garbage cleaning activity.

- Handing over ceremony of the bridge inspection vehicle: The Handing over ceremony of the bridge inspection vehicle was held on April 7th 2017 at the RDA Head Office with participation of Hon. Minister of Higher Education and Highways and Chief Representative of JICA Sri Lanka Office. Demonstration of the function of the vehicle and introduction of the project activities were made at the ceremony.
- Uploading news and topics of the Project in a Facebook page: The PT started a Facebook page in August 10th, 2017. Information on project activities is uploaded continuously in the page. There are some videos about bridges in Sri Lanka. There are 10,000 followers for the page as of Oct. 12th, 2017. It was useful for informing the public about the volunteer garbage cleaning activity and photography and drawing contest explain below.
- Volunteer (Public interested in our activities, various age groups and from various places) garbage cleaning activity: Volunteer garbage cleaning activity with an aim of creating awareness of importance of protecting bridges and its environment was held as follows. 60 volunteers participated in the activity in total:
 - At Kaduwela Bridge (B263) and Digarolla Bridge (Old Galle Road) on August 5th, 2017 with participation of 40 volunteers.
 - At Borupuna Bridge (B388) on August 12th, 2017 with participation of 30 volunteers.
 - At the No. 1/2 bridge (Kelanimulla – Mulleriyawa – Koswatta new road) on August 19th, 2017 with participation of 35 volunteers.
- Photography and Drawing Contests: As a part of awareness creation to protect the bridges, photography and drawing contests were held in July – Aug. 2017. 20 school children and around 100 adults participated in the contests on photography and drawing respectively. An Exhibition of the photography and drawings was held from Sept. 25th to 29th at the RDA Head Office and the prize giving ceremony was held on Sept. 29th, 2017.
- Upload project news to the Facebook page of the JICA Sri Lanka Office: Several news, such as the handing over ceremony of the BIV, volunteer garbage cleaning activity, the photography and drawing contest were uploaded to the Facebook page of the JICA Sri Lanka Office. Information on the third training in Japan conducted from June 11th to 24th, 2017 was also uploaded to the JICA Tokyo International Center.

It was planned to broadcast project activities in TV and radio programme however, the PT decided not to do this, because cost effectiveness was not ensured.

2. Achievements of the Project

2-1. Outputs and indicators

Summary of achievement status of Outputs and that for the output indicators are shown in Table 7 and Table 8 respectively.

Table 7 Summary of Achievement of Outputs

Outputs	Status for Achievement of Indicators as of Oct. 31 st , 2017
1. Bridge management strategy / plan is prepared.	Almost achieved. Bridge management strategy was drafted and will be finalised and approved by the RDA Board meeting.
2. Institutional framework of RDA head office and regional offices (PD, CE, EE) on bridge management is re-established.	Almost achieved. The Institutional framework was finalised and will be approved by the RDA Board meeting.
3. Bridge inspection, diagnosis and repair manuals as well as bridge management guidelines are revised and developed.	Almost achieved. The final draft of the four manuals and a guideline were submitted to the Director, Engineering Services in RDA for his comments. The manuals will be finalised, approved by the Board meeting, printed and circulated to relevant offices in RDA as official documents.
4. Bridge Management Data System (BMS) is established.	Achieved. The BMS was developed and handed over along with the sub-systems to the Director, Engineering Services in RDA. The Japanese Experts are fixing bugs found in the said sub-systems as of Oct. 2017. A budget for maintenance and repair of bridges was produced by the BMS and was proposed as a part of the annual budget of RDA in 2018 (700 Million in total).
5. Basic engineering knowledge of the staff of RDA head office and regional offices in sample provinces is enhanced through seminars and OJTs.	Almost achieved. Through a series of seminars and OJTs, technical skill of engineers and IOs were improved almost as planned. From September 2017, staff of BM&AU, instead of JICA PT, are conducting training programme, which should be conducted continuously from Dec. 2017 onwards.

Table 8 Status of Achievement of Output Indicators

Output Indicators	Status (as of Oct. 31 st , 2017)
1. Bridge management strategy / plan are prepared.	
1-1. Document (s) for bridge management strategy is authorized.	Almost achieved. <ul style="list-style-type: none"> The bridge management strategy was drafted in the PC meeting on Oct. 26th, 2017. It was presented at the JCC meeting on Oct. 31st. It will be submitted and approved by a Board Meeting of RDA.
1-2. Staff of BM&AU and senior management of RDA understood methodology for formation of bridge management plan.	Achieved. <ul style="list-style-type: none"> The bridge management strategy is being prepared. The bridge management plan was developed. Staff of BM&AU and senior management of RDA

Output Indicators	Status (as of Oct. 31 st , 2017)
	understood the methodology of formation of the bridge management plan through a series of workshops.
2. Institutional framework of RDA head office and regional offices (PD, CE, EE) on bridge management is re-established.	
2-1. Roles and responsibilities of BM&AU in RDA head office and regional offices and procedure on bridge management is clearly defined	<p>Almost achieved.</p> <ul style="list-style-type: none"> Roles and responsibilities of BM&AU and other relevant divisions are clearly defined. It should be approved by the Board of RDA. Bridge management procedure manual was developed. It will be submitted and approved by the Board of RDA.
2-2. Budget for bridge management units/offices is requested based on the plan for staff allocation and cost estimate for other necessary resources.	<p>Achieved.</p> <ul style="list-style-type: none"> A budget for bridge management units/offices was requested in the 2018 budget proposal.
2-3. Necessary staff in BM&AU and regional offices is allocated based on the staff allocation plan.	<p>Almost achieved.</p> <ul style="list-style-type: none"> Necessary staff in BM&AU and regional offices was allocated based on the staff allocation plan, except a senior engineer, a system operator and a data analyst at the BM&AU in the head office.
3. Bridge inspection, diagnosis and repair manuals as well as bridge management guidelines are revised and developed.	
3-1. The revised and developed manuals have a guideline for keeping general record of bridges, including defects of bridges.	<p>Achieved.</p> <ul style="list-style-type: none"> The following manuals had been revised, developed, used in the seminars and OJT, <ul style="list-style-type: none"> Bridge Inventory Development Manual Bridge Inspection & Diagnosis Manual Bridge Management Guideline Bridge Repair Manual Bridge Management System Manual They have a guideline for keeping general record of bridges, including defects of bridges, in a quantitative manner.
3-2. The revised and developed manuals have a guideline for keeping records of result of evaluation on soundness of bridges.	<p>Achieved.</p> <ul style="list-style-type: none"> The manuals and guideline have a guideline for keeping records of result of evaluation on soundness of bridges in a quantitative manner.
3-3. The revised and developed manuals have a guideline for keeping the records of measures taken, such as repair, strengthening and reconstruction.	<p>Achieved.</p> <ul style="list-style-type: none"> The manuals and guideline have a guideline for keeping records of measures taken, such as repairs, strengthening and reconstructions.
3-4. Revised and developed manuals and guidelines are approved as official manuals and guidelines of RDA.	<p>Almost achieved.</p> <ul style="list-style-type: none"> The final draft of the four manuals and one guideline were submitted to the Director, Engineering Services of RDA for his comments. They will be finalised by incorporating his comments, approved by Board of Directors, printed and circulated to relevant offices in RDA as official documents.
4. Bridge Management Data System (BMS) is established.	
4-1. Results of inspection and diagnosis of all the bridges in the sample provinces, except those cannot be accessed due to adverse natural	<p>Achieved.</p> <ul style="list-style-type: none"> The relevant information was entered into the BMS.

Output Indicators	Status (as of Oct. 31 st , 2017)
environment and others, are entered into the BMS.	
4-2. Bridge inventory data for all the bridges in the sample provinces, except those cannot be accessed due to adverse natural environment and others are entered into BMS.	Achieved. <ul style="list-style-type: none"> The relevant information was entered into the BMS.
4-3. The BMS has a function to prioritize bridges need for repairs, strengthening and reconstruction.	Achieved. <ul style="list-style-type: none"> The BMS has the relevant function.
4-4. The BMS has a function to assist formation of budget proposals on bridge management.	Achieved. <ul style="list-style-type: none"> The BMS has the relevant function. A budget for maintenance and repair of bridges was produced by the BMS and was proposed as a part of the annual budget of RDA in 2018 (700 Million in total).
5. Basic engineering knowledge of the staff of RDA head office and regional offices in sample provinces is enhanced through seminars and OJTs.	
5-1. More than 95 % of the participants of the seminar answered that “the seminar was fruitful” in the questionnaire survey to be conducted at its end.	Partly achieved and improving. <ul style="list-style-type: none"> This indicator is considered as partly achieved due to the mixed result as follows. However, there was an improvement. <ul style="list-style-type: none"> The first seminar in Aug. 2015: 78%¹ Bridge repair seminar in Jan. 2017: <u>no survey</u>.² Bridge management seminar in July 2017: 95% Bridge inspection seminar in Sept. 2017: 95%
5-2. The staff of BM&AU, as trainers, commenced training for the staff in other provinces (other than the sample provinces of the Project) based on the human resource development plan for the whole region of the country.	Achieved. <ul style="list-style-type: none"> The staff of BM&AU, as trainers, conducted a training course for the newly recruited engineers of RDA in Sept. 27, 2017, as a part of the induction training. It was decided that BM&AU will conduct training once a month so that all engineers of RDA would receive training. This is a part of the human resource development plan to be finalized. The training will be commenced in Jan. 2018, by using the finalized manuals.

2-2. Project Purpose and Indicators

Project Purpose is “Institutional capacity of RDA on bridge management is improved”. The followings are status of achievement of the indicators for Project Purpose. Summary of achievement of indicators for Project Purpose is shown in Table 9.

Table 9 Summary of Achievement of Indicators for Project Purpose

Indicators for Project Purpose	Status (as of Oct. 31 st , 2017)
1. Inspection of all bridges in the sample province	Almost achieved.
2. Expansion of the BMS	Achieved
3. Understanding of the RDA officers in Sample Province to the manuals.	Achieved
4. Certificate of Bridge Inspection	Almost achieved

¹ Level of understanding was lower than expected in the first seminar, mainly because sometimes there was difficulty in English communication between the JICA PT and RDA participants.

² The questionnaire survey was not conducted in the seminar in January 2017, because a part of the seminar was cancelled due to unavoidable reasons.

Indicator 1: For all the bridges in the sample provinces, except those are under construction and cannot be accessed due to adverse natural environment and others, bridge inspection and diagnosis are conducted in line with the revised bridge inspection and diagnosis manuals. [Almost achieved]

As shown in Table 10, all bridges in the sample provinces, except those are under construction and cannot be accessed, were inspected. RDA started inspection of these inaccessible bridges by using the Bridge Inspection Vehicle (BIV) after they obtained it in April 2017. By the end of Oct. 2017, 1,584 bridges were inspected by BM&AU Engineers in Sample Provinces. RDA expects to complete the inspection of most of the bridges by the end of 2017, except those of under reconstruction and small headroom. The results of the inspection were entered into the BMS by staff of BM&AU according to the Bridge Inspection & Diagnosis Manual.

Table 10-1 Number of Bridges in the Sample Provinces Inspected (As of Oct. 31st, 2017)

Province	Western Province	Central Province	Southern Province	Total
Nos. total	737	508	455	1,700
Nos. inspected	717	457	410	1,584
Nos. not inspected as there was no access*	20	51	45	116
% progress	97	90	90	93

Source: BM&AU and JICA PT

Indicator 2: RDA is ready for expanding BMS to entire country within two years from the completion of the Project. [Achieved]

Table 10-2 Number of Bridges Inspected (As of Oct. 31st, 2017)

Name of Province	Number of bridge inspected
Northern	244
Eastern	198
Sabaragamuwa	150
North Western	381
Uva	185
North Central	110
Total	1,268

1,268+1,584 (Sample Provinces) = 2,852 Bridges. $2,852/4,800 = 60\%$ within 4800, 60% of bridge inspections is completed at the end of October 2017

RDA has already started inspection of the bridges in the non-sample provinces. As of Oct.31st, 2017, the inspection has been completed around half in average, although there are variations in different provinces. RDA will complete the inspection by the end of March 2018.

Staff of BM&AU, including those working in the non-sample province, are accessing to the BMS online through the BMS website. They are entering the data as soon as they return the office from the

inspection on the same day. Therefore, there is no time gap between the inspection and data entry.

In this way, BMS has already been expanded to entire country.

Indicator 3: More than 60% of the staff of RDA head office and regional offices in the sample provinces shows their understanding when they participated in the seminars on the revised and developed bridge inspection and diagnosis manuals. [Achieved]

Among the four seminars conducted as mentioned in Indicator 5.1, the last three seminars, which were conducted in January, July and Sept. 2017, were conducted by using the draft version of the manuals. Level of understanding of the participants from the sample provinces in the July and the September seminars was 95%. This was much higher than the target value of 70%. The repair seminar in January was also conducted successfully. Therefore, the PT believe the understanding of the participants should be more than 70%, although there is no information.

Indicator 4: All engineers in BM&AU obtain Certificate of Bridge Inspection [Almost achieved]

After the on-the-job training of bridge inspection, eight out of nine engineers in BM&AU obtained the Certificate of Bridge Inspection. This means those engineers gained basic knowledge and skill to fill-in the seven kinds of inspection forms accurately. The engineer who has not obtained the certificate will go through additional training conducted by RDA.

3. History of PDM Modification

Indicator 5-1 for Output 5 was revised as follows on the 2nd JCC meeting held on December 18th, 2015. The table below shows comparison of PDM versions 1 and 2 and reasons for revisions.

Items	Version 1	Version 2	Reasons for modifications
Indicator 5-1 for Output 5	More than xx % of the participants of the seminar answered that “the seminar was fruitful” in the questionnaire survey to be conducted at its end. (Target figure of “xx” will be decided in due course)	More than 95 % of the participants of the seminar answered that “the seminar was fruitful” in the questionnaire survey to be conducted at its end.	Target figure was decided as a result of discussion at the JCC considering that it should be as positive as possible with a minimum exception of 5%.

Revision of PDM version 2 was approved in the 4th JCC meeting held on December 20th, 2016. The table below shows comparison of PDM versions 2 and 3 and reasons for revisions.

Items	PDM Ver. 2	PDM Ver. 3	Reasons for revision
Indicator 2 of Overall Goal	Results of inspection and diagnosis of all the bridges on national highways (at prox. 4,800 numbers) in the county are <u>input</u> in the BMS.	Results of inspection and diagnosis of all the bridges on national highways (approx. 4,800 numbers) in the country are <u>entered</u> in the BMS.	Editorial modification.
Indicator 3 of Overall Goal	RDA utilizes information produced by the BMS, such as priorities and cost for repairs, reinforcements and replacements of the bridges in the country, at the time of decision-making.	RDA utilizes information produced by the BMS, such as priorities and cost for repairs, strengthening and reconstruction of the bridges in the country, at the time of decision-making.	Editorial modification.
Indicator 4 of Project Purpose	More than X % of the staff of BM&AU* ³ and regional offices in the sample provinces obtain more than Y marks for the bridge management tests to be conducted at the time of completion of the Project (Target figures of X and Y will be	All engineers in BM&AU obtain Certificate of Bridge Inspection.	Replacement of the indicator. ADG (CD) of RDA suggested that it was not suitable to measure level of capacity development by one or two tests at the time of completion of the Project. It may measure level of knowledge, but cannot

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Items	PDM Ver. 2 decided in due course).	PDM Ver. 3	Reasons for revision
Footnote for the second means of verification of Project Purpose	No footnote	In addition to the arrangement of staff, budget and training, readiness of RDA for the expansion of BMS can be ensured if activities were commenced for around 3,000 bridges in the non-project-targeted 6 provinces, such as data entry of result of bridge inspection to the BMS; and collection of information, which are necessary for calculating importance index, such as distance for detour, frequency of overflow at the time of flooding, traffic volume etc. for each bridge.	measure practical skills, which is equally important. It was also suggested that it is not nice to test the engineers. The PT agreed to measure level of capacity development of BM&AU by practical competency for bridge inspection, which is a basic requirement for bridge management. Provision of the certificate of bridge inspection is a significant event for ensuring the competency. The certificate is a new idea that is given to those who gained practical skills and knowledge for bridge inspection as a result of observation of their work by the JICA PT, especially the inspection forms filled by them. The level of capacity development of the staff of regional office and the sample provinces will be measured by Indicator 3. Addition. Added because "readiness" needed to be specified.
The third means of verification of Project Purpose	Questionnaire survey to be conducted at the seminar on revised manuals	Questionnaire survey to be conducted at the seminar on revised and developed manuals	Editorial modification.

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Items	PDM Ver. 2	PDM Ver. 3	Reasons for revision
Output 3	Bridge inspection and diagnosis manuals are revised and developed.	Bridge inspection and diagnosis manuals are revised and developed. <u>Bridge repair manual and bridge management guidelines are developed.</u>	Addition. Added because development of a bridge repair manual and bridge management guidelines were added to the activity.
Indicator 3-3 of Output 3	The revised and developed manuals have a guideline for keeping the records of measures taken, such as repair, reinforcement and replacement.	The revised and developed manuals have a guideline for keeping the records of measures taken, such as repair, <u>strengthening and reconstruction.</u>	Editorial modification.
Indicator 3-4 of Output 3	Revised and developed bridge inspection and diagnosis manuals are approved as official manuals of RDA.	Revised and developed manuals and <u>guidelines are approved as official manuals and guidelines of RDA.</u>	Addition. Added because development of a bridge repair manual and bridge management guidelines were added to the activity.
2 nd and 4 th Means of verifications for Output 3	-	<ul style="list-style-type: none"> • Developed bridge repair manual and bridge management guidelines • Approval of developed bridge repair manual and bridge management guidelines 	Addition. Do
Activity 3-2	Bridge inspection and diagnosis manuals are drafted.	Bridge inspection, diagnosis and <u>repair manuals as well as bridge management guidelines are drafted.</u>	Addition. Do
Activity 3-4	Bridge inspection and diagnosis manuals are finalised and distributed to related divisions.	Bridge inspection, diagnosis and <u>repair manuals as well as bridge management guidelines are finalised and distributed to related divisions.</u>	Addition. Do
Activity 5-3	On the Job Trainings on bridge inspection and diagnosis are conducted in sample provinces. Long-term expert	On the Job Trainings on bridge inspection, diagnosis and <u>repair are conducted in sample provinces.</u> Deleted	Addition. Do
Long term expert (input – Japanese side)			Deleted. Deleted because JICA decided not to dispatch a long-term expert

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Items	PDM Ver. 2	PDM Ver. 3	Reasons for revision
Short-term experts (input – Japanese side)	-	Asset management	Addition. To undertake technical transfer on bridge management in the workshops and the PC meetings
Procurement of machinery and equipment (input – Japanese side)	-	9 pole cameras	Addition. To see the bridges even indirectly where inspectors cannot approach and complete the inspection of bridges in 3 sample provinces within the project period.

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4. Others

4-1. Results of Environmental and Social Considerations

Not applicable

4-2. Results of Considerations on Gender/Peace Building/Poverty Reduction

Not applicable



III. Results of Joint Review

I. Results of Review based on DAC Evaluation Criteria

(1) Relevance

National Road Master Plan (2007-2017), which is the executive summary and the investment plan of RDA, emphasized the importance of the road sector for minimizing disparity among regions in Sri Lanka, and contributed balanced national development. Bridges are indispensable part of the road, which ensure connectivity, the basic function of the road. Therefore, the objective of the Project has consistency with the Master Plan of RDA.

However, at the time of project planning, 42% of the bridges under RDA's purview was more than 50 years old (2010). In 2020, it was said that this percentage would be around 60%. According to the experience of Japan and other countries, it is known that maintenance cost of the bridges become higher at an accelerated rate when they become 50 years old or more. Therefore, there was a need for RDA to establish appropriate system for bridge management, including bridge management strategy, institutional framework, manuals, database system, human resource development and others.

"Promotion of economic development" was one of the important strategies in the "Country Assistance Policy of Sri Lanka" of Japan at the time of project planning (2012). Development of transport infrastructure, which improves domestic logistics, was one of the target areas of the policy. Strengthening of transport infrastructure network is one of the programmes under the plan.

This project has been highly relevant to the development plan and development needs of Sri Lanka, as well as Japan's ODA policy. Therefore, its relevance is high.

(2) Effectiveness

The five outputs were either achieved, or going to be achieved in due course, if the Bridge Management Strategy, as well as the institutional framework and four manuals and one guideline, are approved by the Board Meeting of RDA. RDA officials confirmed to make necessary steps for the approval in due course. All the expected products were produced and utilized, and measures were taken as planned for capacity development of the staff of RDA.

Achievement level of the indicators of the Project Purpose is also positive. RDA almost completed inspection of the bridges in the sample provinces and was ready for expanding BMS to all the regional offices in the country. Staff of BM&AU had gained sufficient knowledge and experience on bridge management. We can conclude that Institutional capacity of RDA on bridge management was improved as expected. Therefore, Project Objective was attained and effectiveness of the Project is high.

(3) Impact

There is a good prospect that Overall Goal will be achieved before 3 years from completion of the Project. Therefore, impact of the Project is high.

(4) Efficiency

Project period was as planned (3 years). Project cost was within the planned amount. Equipment was provided almost as planned schedule. Counterpart trainings in Japan were conducted as planned. All five Outputs of the Project were produced to greater extent.

However, these Outputs could have been attained much earlier, in case the Project could avoid delay in development of bridge management strategy/ plan, institutional framework, manuals and guideline and BMS. These delays were happened mainly due to a long delay in dispatching a long-term JICA PT on bridge management policy, who had not dispatched after all, fundamental revisions of the manuals and guideline when the previous versions were almost finalised, and interruption of dispatch of the JICA PT on BMS. Training to the staff of BM&AU should have been conducted more efficiently, if all nine engineers from the province were assigned from the beginning.

Therefore, efficiency of the project is fair.

(5) Sustainability

(5)-1. Related Policy and Institutional Aspects for the Sustainability of Project Effects

Based on the results of project activities and present bridge conditions, RDA should take major directions to ensure the safe, secure, comfortable and reliable road network for the public were discussed and summarized as the bridge management strategy.

In order to implement the bridge management strategy, necessary setups were discussed in a series of PC meetings and WGs, such as institutional arrangement, human resources development plan, bridge management procedures, budgetary arrangement, etc. These results were documented and compiled in the production of the Project. Roles and responsibilities of BM&AU at the regional offices and the head office, and other related sections were also defined.

The above will be presented and approved by the Board Meeting of RDA. The contents of the Strategy will be continuously referred by RDA, if this is realized.

At the planning of the Project, there were not many bridge-specialized engineers in regional offices. Bridge inspection was conducted by the engineers and TOs in EE Offices without sufficient knowledge and experience about bridge inspection. As a result of the Project, engineers of BM&AU, who were trained by the Project, were assigned at every regional office. They will conduct inspection of the bridges in the area continuously at least once in every five years for each bridge. This arrangement ensures better quality, continuity and periodic inspection of the bridges.

However, it is a concern that this post could be vacant if a BM&AU engineer working for a regional office, who was trained by the Project, is transferred to other area, is promoted to higher position, or leave the organization. This is a potential risk in terms of sustainability, because there is no person other than the 12 officers currently working for BM&AU, who had obtained intensive training on bridge inspection in the Project. Therefore, it is necessary to train more numbers of engineers on bridge inspection by conducting periodic training. It is also important to arrange at least three month period of handing overlapping the tasks and transfer techniques from the current staff to the new staff.

(5)-2. Technical aspect

It is a positive factor that the engineers of BM&AU were trained to an expected level in the Project. Staff in the three sample provinces were also obtained training. It is appreciated that the head of the BM&AU and some engineers in the unit, had already conducted training on bridge management for staff of RDA.

However, according to the observation by the JICA PT, most of the engineers of BM&AU had obtained sufficient skills on inspection, but not diagnosis. At this moment, only the head of BM&AU has appropriate skills for diagnosis. It is mainly because diagnosis needs the knowledge and experience of designing. It is necessary for the BM&AU engineers to improve their skills on diagnosis by experiencing the bridge design.

To activate the bridge management cycle, repairs of bridges need to be conducted timely and properly. As for the bridge repairs, the Project produced the Bridge Repair Manual and conducted OJT on bridge repair for the staff of the sample provinces. However, this training is mainly by desk study, along with a limited practical training on several repair methods. There should be more need of capacity development for bridge repair to the RDA engineers, so that they can carry out proper supervision at the time of a bridge repair.

There is no particular need of maintenance of the BMS. RDA can consult with any local IT company when they wish to expand or modify the system, as it uses technology of open sources.

(5)-3. Financial aspect

As a result of the Project, RDA proposed a separate budget for bridge repair and maintenance for year 2018 to the Ministry of Finance, where there was no such budget for the bridges before the Project. This is a positive factor for sustainability of the Project, which ensures the specific investment to the bridges other than the roads. RDA has done this because they now have scientific documents produced by BMS, to support the proposal. RDA can do the same for every yearly budget proposal as well as for proposals for donor assistances.

Necessary spare parts and consumable for the bridge inspection vehicle are available in the country through local agents of the Japanese manufacturer. However, RDA needs to secure budget allocation of purchasing them, around 1 million per year, from the second year after completion of the Project, or when those provided along with the vehicle are consumed. The server fee for BMS should be paid monthly by RDA; however, there will be no problem with this as it is a small amount.

As mentioned above, there is no serious concern in terms of policy, institutional and financial aspects of sustainability. The limited number of trained engineers on bridge management is a challenge for RDA, in case of a need for a replacement. Sustainability of the effect of the Project is high, if RDA takes necessary measures, for example, training programme suggested in the "Recommendations" of this document; otherwise, it is fair.

2. Key Factors Affected Implementation and Outcomes

Key factors affected implementation and outcomes of the Project and measures taken for overcoming the problems caused by the factors are shown in Table 11.

Table 11 Key Factors affected Implementation and Outcomes of the Project and Measures Taken for Overcoming the Problems Caused by the Factors

Key Factors Affecting Implementation and Outcomes	Measures Taken for Overcoming the Problem Caused by the Factors
<p><Absence of a Project Manager of RDA></p> <p>It was planned at the time of signing of the Record of Discussion of the Project, that the Project Manager should be the Director (Planning) of RDA. However, at the commencement of the Project, the post of the Director (Planning) was vacant substantially, after the former Director had retired several months ago. The Deputy Director (Planning) was acting as the Director; however, she was not able to undertake the post of the Project Manager, as she was extremely busy by covering several vacant positions in the division. Due to this, for around two months from the start of the Project, there was no Project Manager for the Project.</p>	<p>It was agreed between RDA and JICA in April 2015, that Director Engineering Services be the Project Manager, and BM&AU would be located under him. It was also agreed that Director Engineering Services make necessary coordination for the Project with other divisions and sections of RDA.</p>
<p><Project Office></p> <p>Provision of the project office was delayed for two months. Consequently, JICA PT had a difficulty to commence the project activities smoothly.</p>	<p>RDA provided a project office.</p>
<p><Delay in conducting activities for Output 1 & 2></p> <p>JICA Expert Team had a difficulty in conducting activities for Outputs 1 and 2 because a long-term JICA expert, who supposed to be dispatched at the beginning of the Project, had not been dispatched (there was no dispatch at all). The delay in Outputs 1 and 2 made the PT difficult to carry out activities for Outputs 3, 4 and 5 as planned, as some work items were interlinked among these Outputs.</p>	<p>It was decided, in February 2016, to form a Planning Committee (PC) to compensate the roles of the JICA long-term expert. There were series of meeting conducted by the PC for discussing and making necessary decisions for Outputs 1 and 2. RDA organized an internal Working Group for making proposals to the PC meetings.</p>
<p><Delay in development of the BMS></p> <p>Interruption for dispatch of a short-term JICA expert on system / database for around one year since Sept. 2015, caused a delay in development of the BMS.</p>	<p>Two short-term JICA experts on BMS were dispatched from May 2016.</p>
<p><Staffing and supervision of staff of BM&AU></p> <p>As of the end August 2015, after six months from the commencement of the Project, there were 4 vacancies (Senior Engineer, data analysis, asset management, Engineer from North Western Province) in BM&AU. The Engineer from Western Province has not reported to work although he had already obtained an appointment to the Unit.</p> <p>JICA PT had difficulty in communication with Head of BM&AU at the beginning since he was working in RDA Head Office.</p>	<p>An Engineer in-charge of North Western Province was assigned to BM&AU. The Engineer for North Western Province reported to work. The Head of the BM&AU became DD (BM&AU) full time.</p> <p><u>At Nov.2015 3 BM&AU Engineers (6 Vacant)</u></p> <p><u>At Jan. 2016 5 BM&AU Engineers(4 Vacant)</u></p> <p><u>At May 2016 9 Engineers (Fulfilled)</u></p>

Key Factors Affecting Implementation and Outcomes	Measures Taken for Overcoming the Problem Caused by the Factors
<p><Technical transfer on repair work></p> <p>It is necessary to carry out bridge repairs, in addition to inspection and diagnosis, so that RDA can implement the bridge maintenance in accordance to the bridge management cycle. However, there was no component in the Project for development of a repair manual and conducting OJT on bridge repairs.</p>	<p>JICA and RDA agreed to implement activities of bridge repairs in January 2016. JICA made necessary arrangement to modify scope of work of the JICA PT. A bridge repair manual was documented and OJT on bridge repair was conducted.</p>
<p><Delay in finalizing the manuals and guideline></p> <p>The manuals and guidelines were planned to be completed by October 2016; however, it was delayed for around one year, due to the need of the fundamental revisions.</p>	<p>The JICA PT worked harder and completed the draft manuals and guidelines in October 2017.</p>

3. Evaluation on the results of the Project Risk Management

The following important lessons learned from the similar JICA project implemented in the past in the Philippines and Kyrgyz were identified by the Project at the time of planning (See Ex-post Evaluation Summary of the Project).

- Technical transfer becomes more effective by offering opportunities for experiencing the inspections and repairs in the field in a pilot project.
- Leadership capacity of the counterpart personnel is improved through experience in playing a role of instructor at the practical training in the field.
- Contents of the manuals to be developed should reflect the needs of the counterpart personnel and become appropriate in technical level of them, by reviewing the existing manuals with them and identifying their technical level at the beginning.

The Project had taken the above-mentioned lessons and brought a successful result for production of Outputs as follows:

- The PT conducted a baseline survey on the existing manuals and technical level of the RDA staff on bridge inspection, and shared the result with the counterpart personnel at the seminars.
- The PT incorporated findings from the OJT conducted by the JICA PT to the BM&AU engineers into the Bridge Inspection and Diagnosis Manual. As a result, the manuals became appropriate level for the engineers. The engineers also gained know-how to revise the manuals in future if needed.
- The PT conducted the practical training in the field during the seminars for the staff in the sample provinces, in addition to the lectures on theory. Technical transfer became effective as they have gained real experience in addition to the understanding of the theory.
- By using the Bridge Repair Manual, the PT conducted theoretical seminar on repair method in accordance to the kinds and causes of damage and selection of appropriate repair methods. In addition to this, the counterpart personnel conducted simple repairs on a trial basis, including

repairs of spalled / delaminated concrete cover by plastering, and cleaning and repainting of steel structure. This practical experience made RDA, as an institution, realized necessary materials, machinery and training needs for bridge repairs in future.

- BM&AU Engineers attached to Provincial Director Office, who were trained in the Project, became trainers and conducted the bridge management seminar. They had provided answers to the questions raised by the participants in the seminar, too. This experience deepened their understanding of the bridge management and expanded their capacity as trainees.

4. Lessons Learnt

- Input of JICA Long Term Expert was not fulfilled, therefore in order to prepare Bridge Management Strategy, committees with Directors in relevant departments in RDA were established. By this system the activity, was accelerated and it is a useful system even though JICA long term expert was assigned.
- For smooth commencement of the Project, inputs by the Government should be confirmed by JICA prior to the mobilization of JICA PT.
- Bridge repairs and strengthening works should be positively included in the project "scope of works"; otherwise the bridge management cycle will not be complete.
- Manual was prepared together with C/P. As a result, manuals will be suitable to local conditions.
- The OJT was initially from the Japanese Experts and finally the C/P explained the contents effectively.
- Preparation of OJT is essential not only from Japanese side but also the C/P side, such as awareness of OJT, working gear at site, etc.
- Bridge maintenance work has no popularity compared to design work and new construction work. C/P focused on the matter of allowance hence bridge maintenance work is mandatory work of C/P as the whole the whole organization should be aware of the importance of maintenance work.
- Technical improvement of BM&AU as a master trainer is important for the training, continuous training among themselves to improve their skill and to maintain sustainability.
- To reduce initial defects improvement of design and construction supervision is necessary. For example, revision of design manual, capacity improvement of contractor, etc.

IV. For the Achievement of Overall Goals after the Project Completion

1. Prospects to achieve Overall Goal

The Overall Goal of the Project is “RDA conducts bridge management in a systematic manner throughout the country in accordance to the Bridge Management Cycle*”. The prospects for achievement of indicators for Overall Goal are shown in Table 12. Out of three indicators, one has been achieved already. Other two will also be achieved well before 3 years after completion of the Project. Therefore, if RDA keeps on utilizing effects and outputs of the Project, such as knowledge and experience, manuals and guideline, BMS; Overall Goal of the Project will be achieved in time.

Table 12 Prospects for achievement of Indicators for Overall Goal

Indicators for Overall Goal (To be achieved after 3 years from the completion of the Project)		Prospects for achievement
1	All the bridges on national highways in the country (approx. 4,800 numbers) are inspected and diagnosed in line with the bridge inspection and diagnosis manuals.	[To be achieved in time] As of October 31 st , 2017, the inspection of the bridges in the non-sample provinces has been completed around 40% in average, although there are variations in different provinces. It was conducted in line with the bridge inspection and diagnosis manuals. RDA will complete the inspections by the end of March 2018. Therefore, this indicator will be achieved very soon, certainly before 3 years after completion of the Project.
2	Results of inspection and diagnosis of all the bridges on national highways (approx. 4,800 numbers) in the country are entered in the BMS.	[To be achieved in time] Staff of BM&AU, including those working in the non-sample provinces, are accessing to the BMS online through the BMS website. They are going to enter the data of the non-sample provinces, as soon as the data entering of the sample provinces is completed. Therefore, this indicator will be achieved, certainly before 3 years after completion of the Project.
3	RDA utilizes information produced by the BMS, such as priorities and cost for repairs, strengthening and reconstruction of the bridges in the country, at the time of decision-making.	[To be Achieved in time] RDA has already utilized information produced by the BMS, for their decision making. A budget for maintenance and repair of bridges produced by the BMS was proposed as a part of the annual budget of RDA in 2018 (700 Million in total). RDA is mentioning that they could do so, as they now have scientific evidence supporting the proposal. Therefore, this indicator has been already achieved.

2. Plan of Operation and Implementation Structure of the Sri Lankan side to achieve Overall Goal

RDA has already allocated one engineer of BM&AU, who were trained in the Project, to each PD Office. They are going to continue inspection, maintenance and repair of the bridges on national highways. They are also entering the results of inspection, maintenance and repair into the BMS at this moment. It was decided that the inspection of the bridges should be conducted every five years. The followings are the key points to make sure the sustainability of these procedures:

- Provincial Director's office need to provide necessary support to the engineer of BM&AU at their offices, including provision of vehicles for inspection, assistance of other engineers and TOs, when necessary, so that the engineers can carry out their duty in time.
- BM&AU at the head office needs to provide necessary technical support and conduct monitoring of their duty, including quality and frequency of the inspection, maintenance and repair.
- BM&AU also needs to conduct training program on bridge management, by using the manuals and guideline produced by the Project, so that it can have a pool of engineers to serve BM&AU at the regional and head offices in future.

It is highly positive in terms of sustainability that RDA has already utilized the BMS to the budget proposal. The followings are the key points to make sure the sustainability of the utilization:

- The management of the RDA needs to be fully aware of the BMS.
- Cost rates of bridge repair and reconstruction in the BMS need to be updated timely.
- Information of the bridges, such as inventory, conditions, history of maintenance and repairs, entered into the BMS needs to be accurate and reliable.

3. Recommendations for RDA

(1) Completion and Implementation of the Human Resources Development Plan

It is recommended that RDA complete and implement the Human Resources Development Plan, including the regular training program for all the engineers of RDA on bridge management and intensive training for the future candidates of BM&AU. Providing the training opportunities for bridge design for the engineers in charge of maintenance and management, as well as for maintenance and management for those in charge of bridge design, it is also recommended that to develop their capacity on bridge diagnosis.

(2) Provision of Training for Bridge Repairs to non-Sample Provinces

On-the-job training for bridge repairs, such as repairs of spalled / delaminated concrete cover by plastering works as well as cleaning and repainting of steel structures, was provided to the engineers in sample provinces. It is well known that implementation of bridge repair with good workmanship is necessary to complete the bridge management cycle. It is highly recommended that the trainings of bridge repairs be provided to the relevant staff in non-sample provinces.

(3) Practice for Developing the Bridge Management Plan

RDA officials have gained sufficient understanding about the procedure of developing a Bridge Repair and Maintenance Plan, Bridge Reconstruction Plan, including analysis status of soundness of the bridges, target repair and maintenance level, prioritization and costs; developed these plans as explained by the JICA PT and observed the demonstration. It is advised that the relevant officers in BM&AU to perform regular practices to make sure of their understanding.

(4) Development of an Operation Plan of the Bridge Inspection Vehicle

RDA started using the bridge inspection vehicle in late April 2017, and is getting used to its operation with help of the JICA PT.

It is recommended that RDA develop an operation plan for the vehicle to carry out the inspection of bridges which is having difficulty in accessibility. Preparation of a garage for the vehicle took time. The vehicle is parked at Rathmalana RDA depot with a roof and maintained by RDA mechanical division.

(5) Cooperative activities with relevant authorities

Issues that cannot be solved solely by RDA must be coordinated and managed with relevant authorities (for example river control, traffic control, etc.).

(6) Acceleration of Public Awareness

Condition of bridges (Classification A, B, C, D) and necessary budget allocations shall be revealed to the public. And through the awareness of the public, RDA can attempt to receive the required budget allocations from the Treasury Operations Department.

(7) Technical improvement of bridge construction and bridge maintenance

Technical relation with other engineering institutions such as railway department, shall establish government-industry-education cooperation system in future.

4. Monitoring Plan from the end of the Project to Ex-post Evaluation

- RDA should submit a progress report, especially to the above-mentioned recommendations, to the JICA Sri Lanka Office.
- JICA Sri Lanka Office ensures the submission and provides the advices about the progress if needed.

Result of the Project

ANNEX 1: List of Dispatched Experts, List of Counterparts, List of Trainings, etc.

ANNEX 2: List of Products (Report, Manuals, Handbooks, etc.) Produced by the Project

ANNEX 3: List of PC meeting and Workshop

ANNEX 4: PDM (All versions of PDM)

ANNEX 5: R/D, M/M, Minutes of JCC (copy) (*)

ANNEX 6: Monitoring Sheet (copy) (*)

(Remarks: ANNEX 4, 5 and 6 are internal reference only.)

Separate Volume: Copy of Products Produced by the Project

A handwritten signature in black ink, followed by a curved arrow pointing upwards and to the right.

V. Output of the Project プロジェクト成果品

ANNEX 1: List of Dispatched Experts, List of Counterparts

ANNEX 2: List of Products (Manuals) Produced by the Project

ANNEX 3: List of PC Meeting, Workshop and Seminar

ANNEX 4: List of PDM (All versions of PDM) (*)

ANNEX 5: List of R/D, M/M, Minutes of JCC (copy) (*)

ANNEX 6: List of Monitoring Sheet (copy) (*)

(*) Internal reference only

Separate Volume: Copy of Products Produced by the Project

1/7: Bridge Management Guideline

2/7: Bridge Inventory Development Manual

3/7: Bridge Inspection and Diagnosis Manual

4/7: Bridge repair Manual

5/7: Bridge Management System Manual

6/7: Materials of PC Meeting, Workshop and Seminar

(*) Internal reference only

7/7: PDM (All versions of PDM)

R/D, M/M, Minutes of JCC (copy) (*)

Monitoring Sheet (copy) (*)

ANNEX 1: List of Dispatched Experts, List of Counterparts

1. JICA-PT

Position	Name
総括／橋梁維持管理計画 Team Leader /Bridge Maintenance Plan	高浦 秀明 (Hideaki TAKAURA)
副総括／橋梁維持管理計画 Deputy Team Leader /Bridge Maintenance Plan	浦野 一也 (Kazuya URANO)
橋梁点検 Bridge Inspection	青山 實伸 (Minobu AOYAMA)
橋梁点検補助 Bridge Inspection Assistance	伏屋 和樹 (Kazuki FUSEYA)
橋梁マネジメント Bridge Management	市岡 隆興 (Takaoki ICHIOKA)
橋梁診断 Bridge Diagnosis	羽島 大介 (Daisuke HAJIMA)
橋梁補修 Bridge Repair	加々美 彰 (Akira KAGAMI)
橋梁補修 Bridge Repair2	片岡 一夫 (Kazuo KATAOKA)
システム／データベース System/Database	笠井 利貴 (Toshiki KASAI)
システム／データベース System/Database	石黒 靖規 (Yasunori ISHIGURO)
モニタリング Monitoring	田村 智子 (Tomoko TAMURA)
業務調整 Project Coordinator	夜差 秀明 (Hideaki YASASHI)
業務調整 (ローカル) Project Coordinator (Local)	Dinesh SENADEERA

2. Counterparts

Name	Position
D.K.Rohitha Swarna	Director General RDA
B. V. D. Nimal Chandrasiri (February 2015-August 2017)	Additional Director General (Construction Design) RDA
S. H. U. De Silva (October 2017-)	Additional Director General (Construction Design) RDA
L. S. Premathilaka	Director (Engineering Services) RDA
Vasanthakumar	Head of BM&AU Deputy Director RDA
P. Sampath Perera	Bridge Inspection (BM&AU) (Engineering Services) RDA
Jaliya Anuradha Dissanayake	Maintenance Planning (BM&AU) (Planning) RDA
J. M. Samal Duminda	BM&AU Engineer RDA
C. P. H. Ambepitiya	BM&AU Engineer RDA
W. T. J. L. Weradiwa	BM&AU Engineer RDA
W. J. P. R. P. P. Jayasooriya	BM&AU Engineer RDA
R. M. M. R. Ratnayake	BM&AU Engineer RDA
G. R. Manjula	BM&AU Engineer RDA
R. Arjunna	BM&AU Engineer RDA
M. A. Vathulan	BM&AU Engineer RDA
J.A.P.P.K. Rathnayake	BM&AU Engineer RDA

ANNEX 2: List of Products (Manuals) Produced by the Project

Manuals

Name of Manual	Contents
1. Bridge Management Guidelines	1. Bridge Management Guidelines
	【 Attachment 】
	Attachment 1 - Bridge Management Procedure Manual
2. Bridge Inventory Development Manual	1. Bridge Inventory Development Manual
3. Bridge Inspection and Diagnosis Manual	1. Bridge Inspection and Diagnosis Manual
	【 Attachment 】
	Attachment 1 - Guidelines for Development of Bridge Inspection Record Sheets (Example)
	Attachment 2 - Calculation and Recording of Health Index (HI)
	Attachment 3 - Example of Record and Outputs of Bridge Inspection Record by BMS
	Attachment 4 - Standard Repair Cost and Standard Unit Rate of Bridge Member Repair
	Attachment 5 - Standard Unit Rate for Bridge Reconstruction
	Attachment 6 - Description and Examples in need of Emergency Actions
	Attachment 7 - Examples of Bridge Diagnosis
4. Bridge Repair Manual	1. Bridge Repair Manual
	【 Attachment 】
	Attachment 1 - Specification for Plastering Method
	Attachment 2 - Cleaning the Surface of Steel Members
	Attachment 3 - Specification for Zone Painting
	Attachment 4 - Machinery and Equipment for Repair Work
	Attachment 5 - Outline of Representative In Depth Investigation
5. Bridge Management System Manual	1. Bridge Database System (BDS) - User's Manual
	2. Bridge Database System (BDS) - Administrator's Manual
	3. Bridge Inspection Support System - User's Manual
	4. Bridge Repair & Maintenance System (BRMS) - User's Manual
	5. BDS Server OS Design Documents
	6. Bridge Management Portal Site - User's Manual

ANNEX 3: List of PC Meeting, Workshop and Seminar

1. PC Meeting

	Date	Topics
PC-1	28/Jun/2016	<ul style="list-style-type: none"> To establish Planning Committee (PC) To bring up mutual understanding of issues on bridge management To agree tentative schedule and themes for PC
PC-2	01/Jun/2017	<ul style="list-style-type: none"> Achievement 1 of Workshop and PC from 2016 to 2017 Remaining Topics of Workshop and PC Important Issues to be Finalised Draft Budget Plan
PC-3	17/Oct/2017 26/Oct/2017	<ul style="list-style-type: none"> Bridge Management Strategy Bridge Maintenance Plan Institutional Framework for Bridge Management in RDA Progress of Project Activities Human Resources Development Plan

2 Work Shop

	Date	Topics
WS-1	24/Aug/2016	<ul style="list-style-type: none"> Flow of Bridge Maintenance Work
WS-2	20/Oct/2016	<ul style="list-style-type: none"> Issues Extracted from Baseline Surveys Bridge Inspection and Evaluation System in Several Countries and Bridge Inspection System Provided to RDA, Sri Lanka Landing Points of PC Meeting / Program of Workshop and PC Meeting Bridge Management Indices and Target Bridge Management Levels in Japan Bridge Management Plans in Shizuoka Prefecture, Japan Report from RDA Working Group (WG) on September 13, 2016 Progress of Project Activities Issues on Institutional Framework for Bridge Management within RDA
WS-3	25/Nov/2016	<ul style="list-style-type: none"> Project Concept Based on Baseline Analysis Definition of Health Index (HI) & Its Usage Target Management Standards Evaluation of Conditions of Bridges Cost Estimate of Bridge Repairs in BMS Prioritization (Evaluation items , Weighting Factors) Report from WG held on Nov. 9, 2016
WS-4	08/Mar/2017	<ul style="list-style-type: none"> Revision of Bridge Inspection Manual Selection of Bridges for Reconstruction Standard Bridge Repair Method for Health Index (Unit Rates for Bridge Repair)
WS-4 Add	25/Apr/2017	<ul style="list-style-type: none"> Schedule of WS and PC from April to June 2017 Definition of Health Index (HI) = 0 Definition of Important Index Institutional Framework of Bridge Maintenance
WS-5	16/May/2017	<ul style="list-style-type: none"> Calculation Result of BMS by Using Inspection Data from Sample Provinces / Bridge Maintenance Scenario Bridge Repair and Maintenance Plan Institutional Framework for Bridge Maintenance Work in RDA Next PC Meeting (Strategy and Institutional Framework)
WS-6	28/Sep/2017	<ul style="list-style-type: none"> Bridge Management Procedure Bridge Diagnosis and Emergency Action
WS-7	04/Oct/2017	<ul style="list-style-type: none"> Analysis of Bridge Inspection Results in 3 Sample Provinces RDA Action Plan for Bridge Management Amendment of Work Procedure JICA Recommendation of Human Resources Development Plan

3.Seminar

	Date	
S-1 Theoretical and Practical seminar	2015/08/20 (Theoretical seminar)	<ul style="list-style-type: none"> • Outline of the Project • Bridge maintenance work • Purpose of inspection • Explanation of bridge type • Inspection work • Diagnosis • BMS • Repair work • Report from sample provinces
	2015/08/21 (Practical seminar at site)	<ul style="list-style-type: none"> • Recognition of present condition of RDA Bridge. Explanation of site inspection
	2015/08/24 (Practical Seminar at site)	<ul style="list-style-type: none"> • Recognition of present condition of RDA Bridge. Explanation of site inspection
S-2 Bridge Repair Seminar	2017/1/16- 2017/1/24	<ul style="list-style-type: none"> • General information of bridge repair method • Plastering method for concrete structure and zone painting for steel structure • Demonstration for plastering method for concrete structure and zone painting for steel structure • Generation of rust • Site visit – Inspection method
	2017/2/20- 2017/3/2	
S-3 Bridge Maintenanc e Seminar	2017/07/25 (Central)	<ul style="list-style-type: none"> • Functions required of bridges • Bridge management
	2017/07/26 (Western)	<ul style="list-style-type: none"> • Bridge inspection • Bridge diagnosis
	2017/07/27 (Southern)	<ul style="list-style-type: none"> • Bridge repair
S-4 Bridge Inspection Seminar	2017/09/19 (Western)	<ul style="list-style-type: none"> • Outline of the Project • Bridge inspection
	2017/09/22 (Southern)	<ul style="list-style-type: none"> • Bridge diagnosis & emergency action • Desk bridge inspection
	2017/09/19 (Central)	<ul style="list-style-type: none"> • On-site inspection/ inspection results review • System data input

ANNEX 4: PDM (All versions of PDM)

Ver.0 2015 02/23

Ver.1 2015 08/07

Ver.2 2016 12/18

ANNEX 5: R/D, M/M, Minutes of JCC (copy) (*)

R/D 2014 09/30

JCC No.1 2015 08/07

JCC No.2 2016 02/01

JCC No.3 2016 06/30

M/M 2016 07/30

JCC No.4 2016 12/20

JCC No.5 2017 10/31

ANNEX 6: Monitoring Sheet (copy) (*)

No.1 2015 09/04

No.2 2016 02/08

No.3 2016 10/10

No.4 2017 04/05